CHAPTER 1
INTRODUCTION

1-1. GENERAL.

a. This Job Performance Aid Handbook is intended for use by trained Tank Weapon Gunnery Simulation System (TWGSS), Control Gun (CGUN), and Training Data Retrieval System (TDRS) operators.

b. The purpose of this handbook is to serve as a handy memory jogger to assist trained operators with required procedures.

c. Refer to TM 9-6920-709-12&P-1-1 for more information on TWGSS and refer to TM 9-6920-711-12&P-1 for more information on CGUN and TDRS.

1-2. EQUIPMENT DESCRIPTION.

a. **Purpose of TWGSS.** The TWGSS is a tank-mounted training device that aids the crew in gaining and improving proficiency in gunnery skills without the expenditure of live ammunition. Gunnery and tactical training can be conducted anywhere that eye-safe laser firing is permitted. TWGSS provides the crew with visual and sound effects which accurately simulate real firing conditions.

b. **Functional Configuration.** The TWGSS simulates the firing of the tank's main gun, the firing of the coaxially-mounted machine gun, and the effects of a target tank being hit. The TWGSS consists of three subsystems: firing system, target system, and Training Data Retrieval System (TDRS).

(1) **Firing System.** TWGSS simulates the firing ballistic characteristics of ammunition and the visual and sound effects of firing.

(2) **Target System.** The target system receives firing information from an attacking weapon, equipped with a laser training device, and notifies the crew of the effects of the attack. The attack could come from another TWGSS-equipped tank, a Precision Gunnery System (PGS)-equipped infantry/cavalry fighting vehicle, or a Multiple Integrated Laser Engagement System (MILES)-equipped unit. An instructor using the control gun (CGUN) can also communicate with the TWGSS target system.

(3) **TDRS.** The TDRS is used to evaluate the effectiveness of the firing engagements whether in a tank weapon gunnery exercise or a tactical training environment. The TDRS provides real time analysis for each round fired and engagement undertaken. For more information on TDRS, refer to TM 9-6920-711-12&P-1.

c. **Features and Capabilities.**

(1) Simulates tank firing and ammunition effect on targets.

(2) Provides full fire control interface to enable the tank crew to train using normal engagement techniques.

(3) Provides training capabilities utilizing Class 3A (conditionally eye safe) eye-safe laser.

(4) Interoperable and compatible with PGS, MILES, Laser Target Interface Device (LTID), and Improved Tank Gunfire Simulator (ITGS) (Hoffman Device).

(5) Provides panel gunnery training, target tracking training, scalable target capability, and combat training in a realistic environment with immediate feedback.

(6) Simulates the visual effects of the main gun and coaxially-mounted machine gun. These simulations include tracer, tracer burst on target, burst on ground, and obscuration images.

(7) Provides firing sound effects over tank intercom to include built-in test (BIT) indications. These sound effects include:

(a) Main gunfire signature
(b) Coax gunfire signature
(c) Hit indication
(d) Ammunition loading
(e) System error indication

(8) Provides and stores continuously updated vehicle position and time data information.

d. **Description of Major Components.**

(1) **Transceiver Unit.** Performs the complete weapon effect simulation. The unit is preprogrammed with the physical and operational characteristics of the weapon it is simulating and utilizes lasers to transmit pulses and receive reflections from the targets. The unit determines target position from the laser pulses and transmits the point of impact, type of ammunition, and identity of attacker to the target.

(2) **Tracer, Burst, Obscuration Simulator (TBOS) Gunner's Auxiliary Sight (GAS) Assembly (M1A1 and M1IP).** Provides obscuration, tracer, and burst effects simulation into the gunner's auxiliary sight.

(3) **TBOS Driver Unit.** Provides image data of ammunition being fired, and if hit, provides burst image data to TBOS GAS unit.

(4) **Turret Position Sensor (TPS).** Senses turret position in relation to hull and sends information to vehicle interface unit.

(5) **Vehicle Interface Unit.** Receives electrical power from the tank and distributes power to system components. Interfaces with W10 cable to receive/distribute weapon system status and with control panel for application data.

(6) **Control Panel.** Provides the means to manually input required system functions, subfunctions, and options; upload ammo; select training modes; operate system during training; align system prior to training; and view results of firing simulations and BIT error messages.

(7) **TDRS Memory Card.** Stores firing and target vehicle data needed to set up M1 and M1A1 applications for the intended exercise. Collects and stores exercise events collected during TWGSS training. The stored training exercise events can be retrieved for After Action Review (AAR) with the TDRS computer unit.

(8) **Loader's Panel.** Provides loader with a method of selecting and simulating the loading of specific ammunition into main gun. Also generates sound indicators to tank intercom.

(9) **TBOS Video Mixer Unit.** Mixes video-generated obscuration, tracer dot, and target effects images into sight picture of gunner's primary sight (GPS) during day or thermal modes of operation.

(10) **Retro Detector Unit.** Consists of two reflectors, two laser detectors, and one strobe light: The reflectors reflect laser pulses back to the attacking TWGSS or PGS. The laser detectors receive hit information, including type of ammunition, identity of attacker, and hit point from attacking TWGSS, PGS, or MILES. The strobe light flashes when a tank has been hit. Four units are placed high on the turret to provide 360 degrees of coverage.

(11) **Hull Defilade Detector Unit.** Senses hit to hull of tank, when tank hull is exposed. Four units are placed low on the turret to provide 360 degrees of coverage.

1-2. EQUIPMENT DESCRIPTION (Con't).

(12) **Target Computer Unit.** Receives results of a simulated firing, including hit point, type of ammunition, and identity of attacker. The unit compares this information with the type of target it is programmed to simulate, its size and vulnerability, and determines if there was a near miss, hit, mobility kill, weapon kill, catastrophic kill, or no effect.

(13) **Thermal Imaging System (TIS) Junction Box.** Provides connecting point for electrical input from TBOS video mixer unit to enter vehicle thermal imaging control panel.

(14) **Remote System Interface (RSI) Unit.** Receives satellite signals that continuously calculate vehicle position. Provides a means to view and store the vehicle position during a training exercise. The stored vehicle position(s) and time data can be retrieved for AAR with the TDRS computer unit.

1-3. EQUIPMENT LIMITATIONS.

To operate turret/gun systems in the manual/emergency mode during training exercises with TWGSS, turret power must be ON. Firing of the simulator can be performed using the manual firing device (blasting machine) and GAS.

1-4. OPERATION OF TWGSS WITH DEGRADED VEHICLE SYSTEM.

Operation of TWGSS with a degraded tank fire control system (FCS) is possible as TWGSS includes it's own sensors. Neither the gunner nor commander are required to enter any prompting data or adjustments to the simulator during simulated firing exercise. The simulator determines the projectile flight path from the gun axis and firing tables and is stabilized during time of flight by integral gyros. Examples of degraded FCS components are laser rangefinder inoperative, lead sensor failure, ballistic computer failure, and cant angle failure.

1-5. IDENTIFICATION OF CABLES AND CABLE CONNECTORS.

a. **General**. TWGSS cables are provided with identification bands at the approximate center of each length of cable. Identification bands are flexible plastic tubes that surround each cable and are of a color that contrasts with the cable color. Bands are numbered from W-1 through W-11. TWGSS cables are also provided with an identification band at each cable end. These identify the connector of the cable and the connecting point for that connector. Connectors are typically numbered from J-1 through J-4.

b. **W1 Cable.** Transceiver unit connector J1 to TBOS driver unit connector J2.

c. **W2 Cable.** TBOS driver unit connector J1 to target computer unit connector J2.

d. **W3 Cable.** RSI unit connector J1 to TBOS video mixer unit connector J2.

e. **W4 Cable.** TBOS video mixer unit connector J1 to vehicle interface unit connector J2.

f. **W5 Cable.** Target computer unit connector J3 to: right-front retro detector unit connector J1 and right-rear retro detector unit connector J1.

g. **W6 Cable.** Target computer unit connector J4 to: left-front retro detector unit connector J1 and left-rear retro detector unit connector J1.

h. **W7 Cable (M1A1 and M1IP).** TBOS driver unit connector J3 to TBOS GAS unit connector J1.

i. **W8 Cable.** TBOS video mixer unit connector J3 to TIS junction box connector J2.

1-5. IDENTIFICATION OF CABLES AND CABLE CONNECTORS (Con't).

j. **W9 Cable.** Turret networks box connector U1 to: vehicle interface unit connector J3, Hoffman power, and Hoffman ground.

k. **W10 Cable.** Vehicle interface unit connector J4 to: loader's panel connector J1, TPS connector J1, AM 1780/VRC audio terminals, AM1780 audio ground connection, and AM 1780/VRC mounting nut.

l. **W11 Cable.** Loader's panel connector J2 to: turret networks box (TNB) test connector Test 1, TNB test connector Test 2, Hoffman trigger, line of sight (LOS) unit test connector J3, computer electronics unit (CEU) connector J2, vehicle cable 1W202-9P1, vehicle cable 1W202-9P2, and CEU connector J3.

m. **W12 Cable.** Target computer unit connector J1 to RSI unit connector J2.

n. **Connection and Disconnection Instructions.**

WARNING

DO NOT connect or disconnect cable connectors unless vehicle master power switch is in OFF position and gun/turret drive switch is in MANUAL position. Failure to follow this warning may result in injury or death to personnel if main gun or turret move suddenly.

(1) Align cable connector with connecting point by aligning:

(a) either the red dot at cable connector with red dot at connecting point, or
(b) the keyway at the cable connector with the keyway at the connecting point.

1-5. IDENTIFICATION OF CABLES AND CABLE CONNECTORS (Con't).

(2) For cable connectors with knurled collars, rotate collar clockwise to connect. For all other cable connectors, push straight in to connect.

CAUTION

Any attempt to disconnect a cable connector by pulling only on the cable will damage the cable and cable connector.

(3) To disconnect the knurled collar type of cable connector, rotate collar counterclockwise to disconnect. For all other cable connectors, pull straight out on connector body to disconnect.

1-6. OPERATOR'S CONTROLS AND INDICATORS.

a. The TWGSS control panel provides the means to manually input required system functions, sub-functions, and options; upload ammo; select training modes; operate system during training; align system prior to training; and view results of firing simulations and BIT error messages.

b. The TDRS memory card is placed into a slot in the control panel. The memory card contains tank information necessary for M1 or M1A1 application; training data used to set up ammunition amount, training mode, etc.; and training results collected during exercise. After the gunnery training, the memory card is removed from the control panel and an AAR of training is conducted.

c. The TDRS memory card is ejected from control panel by pressing eject button.

d. The display screen provides a visual display of functions selected and is a monitor for firing simulation results.

e. The ENTER button is pressed after entering action or function data into the TWGSS that was previously selected on the display screen.

f. The ESC button is pressed to exit from a current action or function and return to the previous action or function. If ESC button is pressed while an action is being performed, that action will not be saved or performed.

g. Arrow buttons move the cursor up/right and down/left to desired function selection. All functions, sub-functions, and options are abbreviated along the top and left margin of the display screen. When a selection is made, the selection will be lighted and spelled out at the bottom of the screen. Also, a triangular shaped highlight will appear next to the function selected when a sub-function is selected.

h. The functions listed below are displayed on the left side of the display screen.

(1) SI (Simulation)
(2) AL (Alignment)
(3) SU (Setup)
(4) TE (Test)
(5) CF (Controller Functions)

i. The sub-functions listed below are displayed across the top of the display screen when the corresponding function is selected.

(1) **SI**

(a) RM (Remaining Ammo)
(b) GD (Graphics Display)
(c) LF (Laser Rangefinder)

(2) **AL**

(a) CA (Cant Alignment)
(b) LA (Laser Alignment)
(c) GA (TBOS GAS)
(d) GD (TBOS GPS Day Mode)
(e) GT (TBOS GPS Thermal Mode)
(f) TP (Turret Position)

(3) **SU**

(a) BL (Backlight)
(b) CO (Contrast)

(4) **TE**

(a) EL (Error List)
(b) BT (Built-In Test)
(c) TT (Time Totalizing Meter)
(d) DR (Detector Test RDU)
(e) DH (Detector Test HDDU)

(5) **CF**

(a) TI (Set Time)
(b) AT (Ammunition Turret)
(c) AH (Ammunition Hull)
(d) SV (Software Versions)
(e) DP (Display Position)
(f) DA (Display Attribute)

j. The sub-function options listed below are displayed across the top of the display screen when the corresponding sub-function is selected.

(1) **RM**

(a) MW (Main Weapon)
(b) CO (Coax)

(2) **LA**

(a) M (Measure)
(b) S (Save)
(c) R (Reset)

(3) **GA**

(a) A (Align)
(b) R (Reset)

(4) **GD**

(a) A (Align)
(b) R (Reset)

(5) **GT**

(a) A (Align)
(b) R (Reset)

(6) **AT**

(a) MW (Main Weapon)
(b) CO (Coax)

(7) **AH**

(a) MW (Main Weapon)
(b) CO (Coax)